Australian Experiences with CMMI

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Australian

Defence Materiel Organisation

Australian Defence Materiel Organisation (DMO)

- **The DMO is an Enabling Program in the Australian Defence Organisation responsible for acquisition and through life support of defence systems**
  - **9 Divisions headed by the Under Secretary Defence Materiel (USDM)**
  - **Approx. 8000 military, government and contractor staff**
  - **Four technology divisions (Aerospace, Marine, Land and Electronic Systems) specialise in acquisition**
  - **Process based organisation with allocated business process owners**

Impetus for Software Acquisition Reform

- **Reviews of Australian Defence Major Projects raised concerns related to software intensive systems:-**
  - **"Defence raise its S/W test and evaluation skills; monitor the US DoD Acq Reform process for applicability in Aust." ANAO Report, June 96.**
  - **"New Procurement Approaches should be adopted in the acquisition of Software Intensive Systems." Defence Efficiency Review, March 97.**
  - **"Some software based systems are performing as intended, but others are under continuing review because of operational concerns." ANAO Report, March 98 (New Sub)**
  - **"A study be made of procurement strategies for software-intensive projects, whether stand-alone or embedded in large hardware projects." McIntosh Prescott, June 99.**

Reform Program Objectives

- **Develop policy, guidance & technical advice on software acquisition issues**
- **Improve the application of software project management practices, tools and standards**
- **Develop suitable software training programs**
  - **ACTIVITIES**
    - Capability Evaluation Study & Trial
    - Implement Software Measurement Programs - (PSM based)
    - Conduct Software Acquisition Management (SAM), standards & other training
    - Guidance on Software Safety Critical Issues & extension to CMMI
    - Policy & Guidance on IV&V
    - Improve Software Quality Assurance
    - Raise Australian Industry Awareness of Process Improvement
    - Help & advice to projects on Systems and Software Engineering

Capability Evaluation Study

- **An examination of the utility of capability maturity models and methods, and their use in Australian defence industry.**
- **General Findings:**
  - **Problems that have been attributed to software extend well beyond those directly related to software development capability**
  - **Lack of related policy was a common concern from Defence agencies**
  - **Maturity models offer utility to the systems acquisition process**
  - **Defence should lead industry if it wants to encourage use of CMM-based approaches**

Why the CMMI?

- **Coverage of both Systems and Software engineering in a single assessment**
- **Relevance to the Defence domain - Seen as the “Lead” & acceptable by a majority of DMO Suppliers nationally & internationally**
- **The Continuous representation suits the DMO strategy of “Profiling”**
  - **A profile in this context is a documented characterisation of a project and it’s environment**
    - **assists in determining a project acquisition strategy,**
    - **assists in risk identification**
    - **helps determine a providers ‘required’ process capability profile**

CMMI Trials and Evaluation

- **Undertake CMMI Trial Assessments**
  - Learn the model & assessment method
  - Validate its utility
  - Comprehend the resourcing involved (contractor and DMO)

- **Evaluate utility of CMMI for identifying risks associated with acquisition projects**
  - DMO objective is to use the model to assist in identifying and mitigating risks - interested in a contractor's process capability profile, not a maturity level number

CMMI Trials and Evaluation

- **CMMI Trial Evaluation Details:**
  - **6 full (SE/SW) SCAMPI CMMI assessments conducted over the past 18 months:**
    - **undertaken with the voluntary cooperation of the Australian defence industry**
    - **Scope of trial assessments: level 3 Process Areas to capability level 3 (SE&SW)**
    - **8 – 10 assessors on each assessment (DMO & contractor)**
    - **Four assessments included concurrent ISO 15504 assessments based on the same body of evidence**

CMMI Trials and Evaluation

⇨ SCAMPI Trial Evaluation Results:

- Evaluation trial has fostered Process Improvement in participating organisations (including the DMO itself)
- Model issues were identified (Change requests submitted)
- SCAMPI method is effective - could be more efficient
- Full SE/SW SCAMPI very resource Intensive (but improving with experience and method improvements)
- CMMI Continuous representation best suits DMO profiling and risk identification/mitigation approach
- Analysis of some contractor weaknesses point to the DMO's acquisition processes

CMMI Trials and Evaluation

- **DMO Quick Look Assessment:**
  - **Developed to address the resource implications of SCAMPI**
  - **Method is essentially a tailored SCAMPI approach**
    - **Typically 3 - 5 days on site with 3 - 5 assessors**
    - **Experienced DMO Lead Assessors (SEI SCAMPI trained leads)**
    - **Assessment scope focused to address specific sponsors needs or concerns (experience to date indicates most sponsor concerns related to CL1 or CL2)**
    - **Corroboration rules relaxed for perceived strengths but not weaknesses (DMO takes the hit)**
    - ***Draft findings* session often not conducted due to time constraints**

CMMI Trials and Evaluation

⇨ Quick Look Assessment Experience

- 4 contractor and 2 DMO internal Quick Looks conducted in three countries for the following sponsor needs:
  - risk identification prior to novation of a contract
  - facilitate dispute settlement - Government Project Office and contractor assessed concurrently (jointly sponsored)
  - risk assessment following source selection
  - determine process suitability for SW maintenance contract
  - DMO internal assessments - gap analysis for PI (SE/SW/A) x 2
  - combined CMMI with Royal Australian Air Force assessment for award of engineering and design authority

CMMI Trials and Evaluation

- **DMO Quick Look Assessments - Findings**
  - **All assessments satisfied sponsors' needs**
  - **Believe all significant weaknesses within assessment scope were identified**
  - **Based on findings and feedback, estimate 80% or greater accuracy for 25 % level of investment of resources compared to SCAMPI**
  - **Quick Look method needs to be flexible to meet sponsors' differing risk assessment requirements**
  - **Greater efficiency possible, particularly in area of MQ and preparation of corroborative evidence**

CMMI - ISO 15504-2 Mapping

- **CMMI to ISO/IEC 15504-2 Mapping - Objectives:**
  - **Ascertaining whether an ISO 15504 compliant appraisal/translation method can be adapted for use with the CMMI model**
  - **Permit comparison of results using different assessment models and method**
    - **DMO acquires systems from contractors in different countries with different model preferences**

CMMI Trials and Evaluation - CMMI - ISO 15504-2 Mapping

- **Recognition:**
  - **Mapping jointly sponsored by the DMO and US Air Force (CRSIP Office) and performed by the Australian Software Quality Institute (SQI) - Griffith University, under contract to the DMO**
  - **Mapping report and tables soon to be publicly released on the SQI web site:**

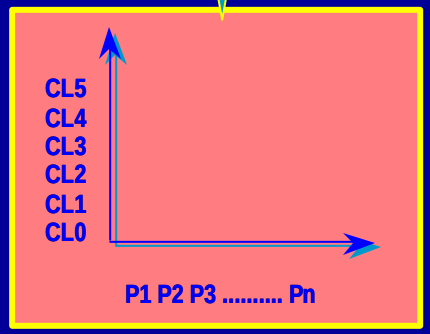
http://www.sqi.gu.edu.au

ISO 15504-5

CMMI

Trillium

Compatibility and Comparability



A common reference framework

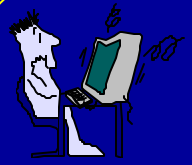
Bootstrap

Process Professional

A Compatible Process Model

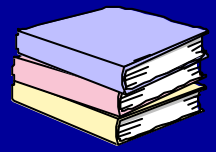
- **A model to support assessment in line with ISO 15504 must be compatible with the reference model.**
- **Requirements for compatibility are expressed in terms of:**
  - **purpose;**
  - **scope;**
  - **model elements and indicators;**
  - **mapping;**
  - **translation.**
- **These requirements span various levels and model features.**

Evidence



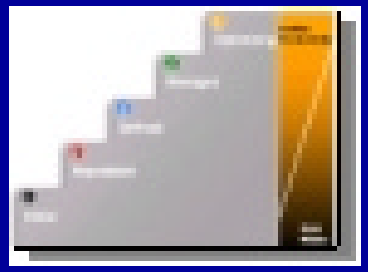
Technology

Interviews

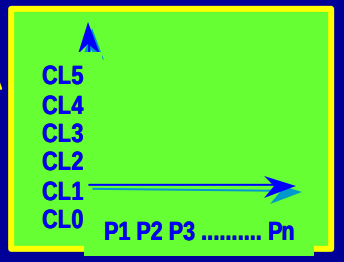


Documents

CMMI Rating

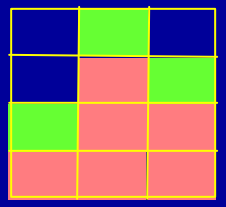


ISO 15504 Rating



Translation Mechanism

Common Process Profile



Next Steps

- **Complete the CMMI Mapping to ISO 15504.**
  - **currently 18 of the 22 Process Areas in the Continuous Model have been mapped, though some mapping was to the earlier version of CMMI.**
- **Develop a "Translation Mechanism".**
  - **It does not appear that a simple "algorithmic" translation of CMMI Ratings to an ISO 15504 Process Profile will be possible.**
  - **Any translation approach initially will be based on assessment of ISO 15504 Process Attributes based on evidence from recorded observations.**
  - **The SQI has developed a preliminary specification for a simple tool that will make this easier.**
- **Evaluate the Translation Approach in further trials.**

Mapping Conclusion

- **There is no barrier to the use of CMMI as a model for ISO 15504 conformant assessments**
- **Some elements of the ISO 15504-2 Reference Model not address by CMMI**
- **Translation is more complex than expected and will need to rely on tool support**

Safety Critical Systems

- **The DMO acquires software intensive systems; many systems are categorised ‘safety critical’ (following hazard analysis)**
- **Developing Safety Critical Systems is a high-risk activity which requires specialised processes, skills and experience**
- **CMMI is a generically structured framework which requires amplification for specialised areas of systems and software engineering.**
- **A company assessed using CMMI as adequately capable may have inadequate processes for dealing with safety**

Safety Critical Systems

- **DMO, in conjunction with the Australian Software Verification Research Centre (SVRC) - University of Queensland, has developed a safety extension titled "+ Safe" (plus safe) for use with the CMMI model (continuous representation)**

Safety Critical Systems

- **+ Safe has been designed to address the following DMO requirements:**
  - **need to assess an organisation's safety processes to identify strengths and weaknesses**
  - **suitable for use either stand alone, or as part of a larger CMMI assessment**
  - **be consistent with Australian Defence Standard Def(Aust) 5679 and, where feasible, with other contemporary safety standards (IEC 61508, Mil-Std-882C, DefStan 00-56)**
  - **developed in the style of the continuous representation of the CMMI**

Safety Critical Systems

- **Structure of the + Safe extension (V0.17):**
  - **Two new safety Process Areas**
    - **Safety Management**
    - **Safety Engineering**
  - ***Safety Management* contains three specific goals and seven specific practices**
  - ***Safety Engineering* contains five specific goals and thirteen specific practices**

Safety Critical Systems

- **+ Safe has been trialed by the DMO on 6 CMMI assessments (SCAMPI and Quick Look) and improvements incorporated**
- **Valid safety concerns were identified in assessments using the extension**
- **DMO intends to invite evaluation by other interested organisations (MOD UK, US DoD, US FAA, NASA)**
- **V1.1 release intended to incorporate further improvements**

Future CMMI Related Activities ?

- **Better define, measure and improve the efficiency of the DMO Quick Look assessment method**
- **Support ongoing DMO internal Process Improvement activities**
- **Investigate the concept of determining the constructed capability of multi-contractor development teams**
  - **perform a series of Quick Look assessments; scope each assessment to address the organisations' principle roles in the consortium**

Summary

- **CMMI Model & assessment method provides for independent and undisputed (so far!) process finding**
- **Has helped drive both DMO internal and Australian Defence industry process improvement**
- **Helps with risk identification and therefore improved management in capital acquisition programs**
  - **helps educate and augments skills and experience levels of DMO acquisition staff**

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